



Defense Information Infrastructure Common Operating Environment I&RTS Review and Assessment

**Prepared on Behalf of
DEFENSE INFORMATION
SYSTEMS AGENCY
(DISA)**

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1.0 EXECUTIVE SUMMARY

The Defense Information Systems Agency (DISA) has made significant progress toward the definition and implementation of a set of specifications as outlined in the Defense Information Infrastructure (DII) Integration and Runtime Specification (I&RTS). The overall purpose of this effort is to establish a foundation to enable full interoperability between DoD computer systems. In support of this effort, GartnerConsulting was engaged to assess the current specification as to its completeness, mission-effectiveness, cost-effectiveness and the probability of success from an internal DoD and external commercial acceptance perspective.

Based on a thorough review of the DII COE Integration and Runtime Specification (DII COE I&RTS) v 3.0 coupled with a number of on-site sessions and conference calls, GartnerConsulting has reached the following summary conclusions:

- The current approach is extremely pragmatic and should provide significant value to DoD if rigorously followed and actively enhanced. This is especially true with regard to issues such as the inclusion of Microsoft NT into the overall mix. All platforms and operating environment should be dealt with in a similar and highly disciplined manner. Exceptions will only weaken the positive impact on the organization, and in fact will cause significant problems long term as the core environment fragments back to proprietary implementations. The overall process requires a high degree of institutionalization and rigor. The process and deliverables should remain focused and be driven in a consistent manner into the organization.
- The technical leadership of the team and the interviewed technologists associated with the development of the approach appear extremely competent and clearly understand the realities of the current approach and required future enhancements.
- The above-noted document and approach address only part of the interoperability challenge. In fact, the current approach really focuses on the supportability, maintainability and repeatability aspects of the lower-level programmatic and configuration challenges. It sets the stage for further interoperability efforts, but does not accomplish true interoperability in and of itself. Physical-level interoperability is partially addressed, but application and true information interoperability are not.
- The approach is fundamentally a pragmatic, implementation-driven attack on the challenge of establishing common and reusable programmatic, configuration and data components which can be used in a consistent and manageable manner. It provides the inventory of component parts, but does not attempt to rationalize them in terms of common application and data processes.



- The overall effort would benefit significantly from a counterbalancing activity that is targeted at addressing true interoperability from the strategic architectural context, one which looks at common processes, messaging semantics and higher-level physical-level interoperability mechanisms. GartnerConsulting also believes that there is an opportunity to further refine the approach around the strategic role of data in this context. Our concern is that a prolonged and purely pragmatic, implementation-driven approach is prone to the creation of real problems if not driven from a strategy and architecture, even an academically based, strategy and architecture.

In summary, GartnerConsulting believes that the current approach and implementation reflect positively against the objectives of this assessment. The DISA organization has developed an effective capability of true value. The bottom line is that while a core competency and capability has been developed, this competency and capability represent only the beginning steps toward the vision outlined as the premise for this study.

The remainder of this document will focus on the specifics of the assessment. As stated, GartnerConsulting will focus less on the core content of the existing body of work (which represents an outstanding capability), and will instead address the issues which we believe will allow the effort to move toward achieving the longer-term goal of full interoperability and reuse.



2.0 SCOPE AND OBJECTIVES

The intent of the activity was based on DISA's desire to have an independent and highly qualified commercial sector organization evaluate the DII COE I&RTS for its applicability with regard to meeting the mission of integration and interoperability within DoD. While the specific scope was the singular document itself, GartnerConsulting extended the view deeper into associated documents and topics in order to meet the intent of the study, which delved more deeply into the concepts of the overall COE and not just the I&RTS content. While not intended to limit the assessment, there were a set of key questions to be answered.

More specifically, DISA stated a desire to address the following issues:

- Assess the specification relative to commercial and general industry trends and directions with respect to interoperability.
- Assess the DII COE I&RTS in terms of its ability to meet the mission of providing a mechanism (or set of mechanisms) for achieving interoperability.
- Assess the approach's ability to save time and money for DoD.
- Assess the overall approach for quality and completeness.
- Address what can be improved and what can be removed.
- Assess the approach in terms of discipline.

Additionally, the assessment was to be one focused at the strategic intent and approach, not at the implementation specifics (unless those specifics were relevant to the strategic intent of the effort).



3.0 GARTNERGROUP APPROACH

The GartnerConsulting approach was very straightforward. DISA delivered a copy of the DII COE I&RTS document to GartnerConsulting for review. GartnerConsulting then conducted a “kick-off” session with Admiral Gauss, Dr. Perry and the project leadership in Washington, D.C. The purpose of this activity was to set expectations and to gain a clear understanding from senior leadership as to the intent and backdrop for the effort. Following this activity, a more formal information-gathering session was held with key DISA personnel in Washington, D.C. The session was used to gain an understanding of the history, intent and on-going activities associated with the effort. Additionally, some preliminary questions about the document raised by GartnerConsulting were addressed. At this time a request for additional documentation was made by GartnerConsulting. DISA provided the 3.0 version of the document and subsequently provided the GGCS/Architectural Design Document for GGCS COE dated 12/15/95, and a proposed new table of contents for the document (to give GartnerConsulting an understanding of the direction of the document organization). A DII/COE Architectural Design Document, based on the GGCS version and updated to address the full scope of DII, is expected to be available in October 1997.

Following a more thorough review of the documentation, GartnerConsulting proposed and held another session with key DISA personnel in Washington, DC to address additional issues and questions about the documents, program direction and intent. At this time, GartnerConsulting also attended a formal presentation delivered by Ms. Dawn Hartley on the COE itself.

GartnerConsulting also held two additional conference calls with DISA personnel to discuss specific issues related to the document in general and the SHADE components in particular.

Based on the document(s) content, the reference sessions and calls, GartnerConsulting developed the following formal assessment in conjunction with its highly experienced research analyst base and extensive consulting experience.



4.0 APPROACH ASSESSMENT

There are three distinctive views which can be taken to the overall DII COE I&RTS approach. It is critical that the GartnerConsulting assessment address and position each one. The first view is that of the explicit content of the document, taken at its absolute. The second view is to look at the true intent of the explicit words. This can only be done with capable interpretation of the DISA staff. The third view is to look at the document in the context of a more complete architecture and delivery capability for true interoperability. While technically beyond the scope of the effort, GartnerConsulting feels that the real value for DISA lies in a closer look at this key view and not in the dissection of the implementation specifics as outlined in the document.

4.1 Assessment View One

The first view, that of the explicit content of the document, is the simplest to assess. The approach and specifications, once past the introduction, background and overview content, are very well-defined and actionable. The specifications define a set of reusable components covering an increasingly broad set of capabilities and describe an approach using “segments” to ensure a consistent runtime environment on a specific platform using the components and other commercial software used to implement the environment. A suite of compliance measures is also included to allow implementations to be evaluated against the specification. To a large extent, the specifications reduce the very complex runtime environment on a specific platform to a consistent set of pieces and processes that go a long way toward ensuring a repeatable deployment process and a well-behaved, supportable runtime environment. The reusable software components establish well-defined, low-level APIs for specific services to ensure a consistent implementation of the service. At the data level there are specifications for data access (and other data-related services) and the definition of an approach to pragmatic schema sharing.

The key issue with the document and the set of specifications, at this first level view, is that since the document lacks an overarching architectural context or application-level taxonomy, the developer (implementer) sees a set of “things” to be used in an absolute sense. There is nothing to provide real overall direction from the developer’s perspective to help determine what is the right piece or if the set of services is in fact of real value. Additionally, the services provided are there because they have been identified based on current needs. The current suite of capabilities in no way covers the full range of requirements, even at this fairly low level. So, at the developer level, the services remain as one option among many to accomplish a goal. A good example of this would be the services around DCE. An implication that one might draw from the document is that DCE is the only way to do function-to-function calls. The document describes no other methods at this point other than for data. In reality, the developer



may require a wide variety of messaging capabilities, many of which cannot be delivered within the DCE services. Again, since the document does not describe its services or products within the context of a full-fledged architectural model, the developer is left to his own devices to determine the application and usage of any piece of the specification.

One other disconcerting sign within the document is that as it moves away from well-defined, low-level services toward higher-level application and data abstractions, it follows the same path of providing incomplete high-level context. A good example here is the highly data-centric view of the SHADE component, which seems to go so far as to encourage developers to embed all business rules in the database or to imply that real interoperability can be accomplished through data sharing. It ignores the fact that while these principles can work for single applications, they fail when the broader application domain is considered. Thus a seemingly strong tactical approach could in reality be very detrimental to the longer-term prognosis of interoperability.

The way GartnerConsulting interprets these facts is that the specifications are excellent in their absolute and explicit description of certain services but are clearly lacking in providing a strategic architectural context for actual use. An analogy would be that of populating a Home Depot with products based on what people ask for the most rather than having a complete picture of the construction domain and stocking products to meet a wide variety of construction requirements. This issue is not that one approach is good and the other bad, but that one approach requires a very mature and complete view of the requirements as well as the funds to "stock" the store vs. a model which is very practical and designed to be the best it can be for a select set of buyers. The danger of a purely implementation-driven, slow product population path is that the developer must do much of the context setting and interpretation in order to make use of the specification. He must know when the service is not the correct one for the requirement and must not automatically default to an inappropriate service.

GartnerConsulting does not fault DISA for the current approach. GartnerConsulting clearly understands the reason why the document and approach exists as it does. We merely want to point out that while the explicit content provides real value, it does not in and of itself constitute the solution or even a large piece of the solution to full-scale reuse and interoperability. It is, however, an excellent base for further efforts and is well beyond the industry in general with respect to consistent runtime environments.

4.2 Assessment View Two

The second view of the effort incorporates the fact that the specification document is in fact meant to be a very pragmatic document which recognizes the realities and attempts to deal with them through marrying the document to the expertise of the DISA



organization. This view's assessment is impacted by the fact that the document is not meant to stand alone and requires interpretation and careful application. It is also impacted by the fact that the DISA organization has limited resources and does not have the formal mission of delivering against all aspects of a complete interoperability strategy.

When viewed from this context, the document becomes a very powerful starting point for achieving the end state. The view says that the specification is meant to be evolutionary and enhancements will be added as high-impact areas are identified. The approach steps up the fact that a holistic architectural context is unlikely and that to achieve value, DISA must have the ability to respond to direct requirements, not possible future needs.

The GartnerConsulting assessment focused on gaining an understanding not just of the content, but of the intent of the document. GartnerConsulting feels it is important to note that in virtually every case, the DISA team was able to effectively address issues which dealt with the interpretation of the document and were able to do so in a very realistic and pragmatic manner. There was nothing absolute about the application of the content. This "soft" fact is key to ensuring that the specifications are truly useable. In terms of this second view of the document, GartnerConsulting believes that there is a solid and growing technical base to support the tenets of the effort, there is a growing ability to apply discipline to a generally undisciplined activity and there is a very healthy dose of pragmatism embedded in the entire activity, which is critical to the incremental, evolutionary approach toward adoption and compliance.

The key challenge from this second view is that even with the pragmatism and even though the team can articulate where it would like to go, the current overall organizational structure, capacity and mission assignment of the groups which are key to achieving true interoperability are such that there is not a high probability that the pieces will come together as envisioned to achieve full interoperability.

4.3 Assessment View Three

The third view focuses on how GartnerConsulting would assess the approach given our understanding of the goal of the original assignment—to assess the approach for its ability to enable full-scale interoperability and reuse.

Building on the previous discussions, GartnerConsulting believes that there is fundamentally one common theme to our assessment results; the current approach is tactical and pragmatic, and quite valuable and effective. However, it is clearly an implementation-driven approach in nature and must adopt a more complete architectural model to move to the next level.



An example of this is embodied in Figure 1. Figure 1 represents a high-level strategic architectural view of interoperability. It starts at the application layer and drives down through the physical runtime environment. It is comprised of specific technologies, APIs, messaging semantics and services. It also attempts to depict softer issues like styles of physical interoperability and to present a high-level taxonomy of some key interrelationships. Full-blown interoperability deals with process/functional and message interaction, not just the physical connection. The telephone system is a good example. There is strong physical interoperability between telecommunications devices worldwide, but if the two parties speaking do not have a common reference point in terms of language then there is no interoperability in the real sense. Taken a step further, even if the two parties speak the same language, if they do not have a working knowledge of the same discussion domain then there is no real interoperability. The words are understood, but not the meaning.

If GartnerConsulting were to equate the current capability of the DISA products to this model (Figure 1), we would point to the lower-level runtime environment, to a portion of the required services and to a few of the actual implementation technologies. Additionally, there are a number of APIs defined to expose the services and implementation technologies. However, there is virtually nothing in place above the API line. Also, GartnerConsulting would point out that the focus of the current effort is on facilitating the rollout of “singular” applications, which is a very different challenge than attacking the issue of common processes. Pieces of the puzzle are in place but no one has the “box top” to see what the puzzle looks like in total or a way to see what is missing. The developer must supply a significant amount of interpretation and must have a strong level of understanding of things implicit in the current implementation (what is missing, what should be used and when, alternatives, etc.). This will have a real impact on the ability to role this out to a broader base.

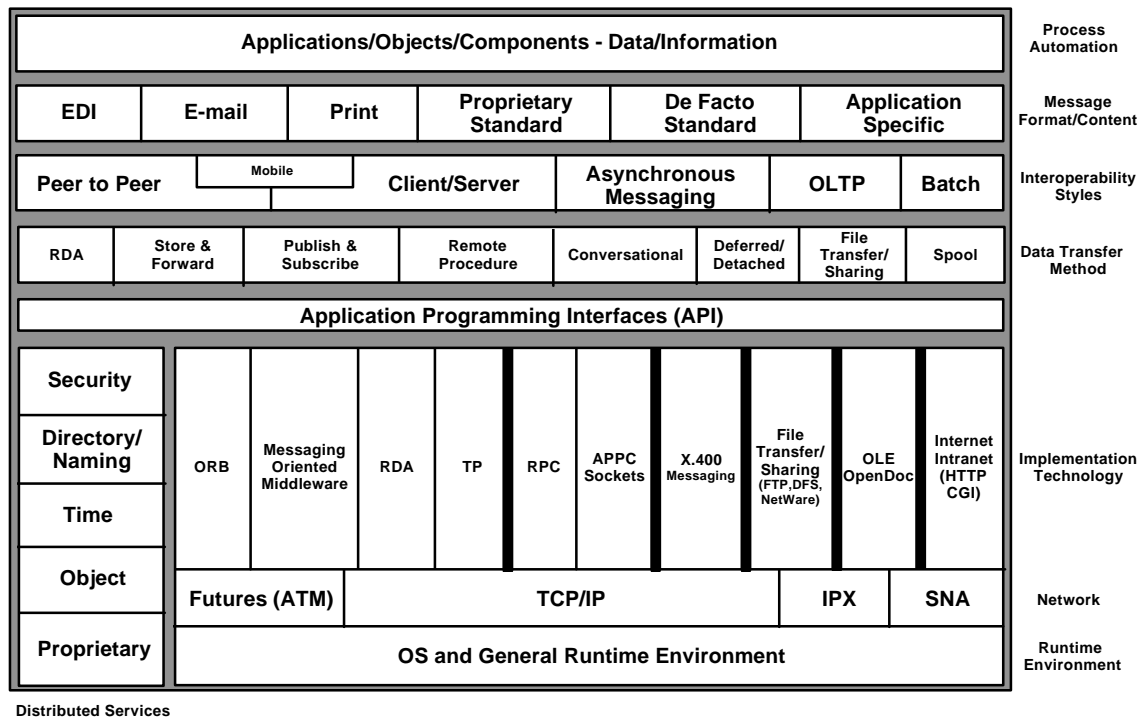


Figure 1

GartnerConsulting recognizes that this more complete view of interoperability is extremely difficult to achieve. It is not our intent to criticize DISA with respect to what is missing, but to point out that while significant progress has been made, the higher-level and higher-value pieces of the interoperability puzzle are yet to be defined. Without these pieces the overall effort will be limited to single applications and only in the context of a stable, consistent and manageable runtime environment with some reusable services. This is of true value to DoD and its impact on achieving the eventual goal of interoperability should not be minimized.

4.4 Additional Assessment Issues

Moving on from the different views, there are a number of key areas about which GartnerConsulting will provide comments. These areas represent opportunities for enhancement or represent issues which we believe must be added to achieve optimal tactical benefit.

- **Strategic Architectural Context**

The effort has matured to the point where a full architectural context is required. The context has two clear roles. One is to provide a road map for the ongoing effort. Without this road map, the effort will evolve somewhat randomly. It will only be by accident that the target is achieved; and what is the target? The



second is to provide developers or implementers with the landscape (options) and how those options fit into the big picture. This helps to determine what to use when, understand what is missing and what should be targeted over time. Additionally, this effort would allow DoD to align roles, responsibilities and funding in a manner conducive to achieving the goal.

- **Middleware Technologies, Styles and Messaging Content**

The current specifications deal primarily with DCE, HTTP and remote data access (e.g., SQL*net). It will be increasingly important that the effort use the broader architectural initiative to establish additional middleware options for inclusion and to position those options with care in terms of appropriate use models. There are a number of different styles of function passing which should be addressed and technology must be provided to support the style. In the ultimate scenario, a messaging content specification and taxonomy will be required so that there is a common language for messages, both for content and meaning.

- **Infrastructure Services**

To support the growing number of distributed messaging options a consistent set of infrastructure and network services will be required. DCE services form the base today, but GartnerConsulting believes that a more complete view must be taken and additional services and implementations must be added.

- **Developer View**

The current approach presents a series of explicit technology implementations and processes to the developer but with little overall context. For example, a full-fledged service-based architecture would describe to the developer a concise set of services like security, directory, time, different messaging implementations (e.g., synchronous, asynchronous, etc.), data access and others. Within these service implementations would be the specific technologies and some form of appropriate API(s) to the final implementation. The developer should be able to understand the function of the service and the different implementation options, hopefully in the context of the high-level architecture. Today, the developer is faced with a set of implementations with few options and little context.

- **Application Development Tool and Languages**

Given the wide variety of development tools and approaches on the market today, some in-depth consideration should be given to the languages themselves. While the work to date focuses on supplying bindings to C/C++ and ADA, some additional consideration should be given to the impact and complexity of other proprietary tools and of purchased application packages with unique interface requirements. Different combinations of tools and middleware will drive different requirements for infrastructure services. When the boundaries are extended to include groupware, e-mail and other associated



application delivery tools, the complexity and permutations can become overwhelming.

- **Holistic Application Function/Process View**

To a large extent the current approach views the delivery domain as one of a series of discreet applications. While this is a very pragmatic approach which allows the maximum application of the current specifications over the shortest period of time, it ignores the true end state of interoperability and reuse. Function and process sharing is difficult, but it is where the highest level of value lies. Additionally, as described to GartnerConsulting in our kick-off session, this is the desired end state. Tactical solutions to difficult issues like data sharing (accomplished tactically through schema sharing) will become unmanageable if not considered in a broader and higher level context.

4.5 Specific Task Assessment Items

In addition to the assessment results outlined thus far, GartnerConsulting was asked to address the following issues (where discussed previously, GartnerConsulting will briefly summarize):

- **Will the approach described in the document allow DoD to achieve interoperability?**

The approach describes an excellent set of tactical processes and deliverables. They are required to achieve true interoperability. However, as currently described and implemented, their real value is in a consistent and well-managed runtime environment. Their affect on interoperability is from the pragmatic, implementation-driven approach at the physical level and within a specific application. The approach is a key step in the process to achieve interoperability. Interoperability will not be achieved merely by applying the current approach, even rigorously.

- **Will the approach save time and money for DoD?**

The approach will clearly save time and money, and at an accelerating rate as the approach is broadly adopted within the development community. GartnerConsulting believes that the saving will be primarily in the area of support and environment manageability and not initially in application development cycle-time reduction. However, GartnerConsulting expects significant additional investment to be required to achieve the next levels of success. The current approach deals with very concrete issues, whereas future enhancements will require movement into more abstract and complex areas. If early successes are not capitalized on through further specification and approach enhancements, cost savings will quickly stabilize and in fact may revert due to the lack of an overall strategic architectural context to guide the effort. The purely pragmatic, implementation-driven approach, if not countered soon with a



strategic architectural development strategy, may over time actually increase the overall complexity of the environment and require significant staff to support it well throughout the development community.

- **Is the approach good and is it complete?**

For what it does the approach is good. However, it is good against the backdrop of it being a foundational set of approaches. As discussed throughout the document, GartnerConsulting believes that the approach would clearly benefit by the inclusion of a number of key enhancements. DISA is in the process of achieving what very few organizations have even attempted. The approach is remarkable in terms of ensuring consistency, supportability and reuse at across a wide variety of infrastructure services and the overall runtime environment.

- **What can be improved?**

A significant portion of this document addresses this issue. While fundamentally excellent for what it addresses, the improvements will come through additional breadth and depth, especially with respect to the strategic architectural context.

- **What can be removed?**

At this point, GartnerConsulting sees nothing substantive to remove.

- **Is the approach disciplined?**

To its credit, the approach is both disciplined and flexible. At full compliance, the approach encourages and requires incredible discipline. However, the approach recognizes the realities of the current user audience and is designed to accommodate many constituencies in a flexible manner. It allows discipline to be applied in reasonable doses; it is not an all-or-nothing proposition. GartnerConsulting finds this to be very forward-looking and reflects the maturity of the organization.



5.0 CONCLUSIONS

While the preponderance of this assessment deals with opportunities for improvement, GartnerConsulting fundamentally believes that the approach, as currently documented, represents a quantum jump in capability. The approach has proven its effectiveness and demonstrates a unique capability within the IT industry. The real challenges lie ahead in terms of tackling the more abstract and complex issues which surround the achievement of full interoperability. The approach does not solve the problem in and of itself. Achieving the goal will require organizational, funding and focus (tactical to strategic) shifts in the near term. However, based on the demonstrated success to date, GartnerConsulting believes that the possibility exists for further inroads into this key IT requirement. We support the rollout of this effort and believe that it represents a disciplined and stepwise approach to the creation of a solid foundation for not only interoperability, but of a supportable and manageable operational environment within the complex distributed IT environment.